From: Powers, David
To: Leinenbach, Peter; Henning, Alan; Kubo, Teresa
Cc: Psyk, Christine
Subject: FW: Presentation for today
Date: Wednesday, January 22, 2014 10:54:56 AM
Attachments: Jan 22_M[redacted]tion.pptx

Pretty cool ppt. presentation on the modeling ODF is doing to support new rule alternatives to increase Riparian Management Area protection. Not as much on the actual alternatives as I'd hoped for but lots of good, albeit complicated info, to support increased FPA no cut buffers and higher BA levels for RMAs.

Pete - See slide 26 re: problems with limiting analysis with 10am – 2pm solar loading assumptions… especially for packed, "poodle tail" treed plantations prevalent on private forest lands (I couldn't figure out how to work in peck of pickled peppers) Pete's analysis/work on ID FPA will come in handy showing thermal loading outside the 10 – 2 window. Feel free to ask clarifying questions. See phone # below…I've got call in to Josh to confirm. Dave

Hi Dave,

I may have given you the wrong number for conference room 10. The correct number is Nonresponsive Nonresponsive This is the direct line to the star phone in the room.

Josh – Dave is looking for a number so Peter can call in. If there is already a conference line reserved let Dave know, otherwise I suggest using this number.

Cheers,

Ryan

–

Ryan Michie
Senior Analyst | Watershed Management Section
Oregon Department of Environmental Quality

From: GROOM Jeremy [mailto:jeremy.groom@state.or.us]
Sent: Wednesday, January 22, 2014 9:50 AM
To: jeffrey.lockwood@noaa.gov; SEEDS Joshua; Powers, David
Cc: FRUEH Terry
Subject: Presentation for today

Greetings,

Attached is the presentation for today's meeting.

Cheers,

Jeremy

Jeremy Groom
Monitoring Coordinator
Private Forests Division
Oregon Department of Forestry
2600 State St.
Salem, OR 97333
503-945-7394

RipStream Riparian Rule Analysis
Analysis tool development & status

22 January 2014

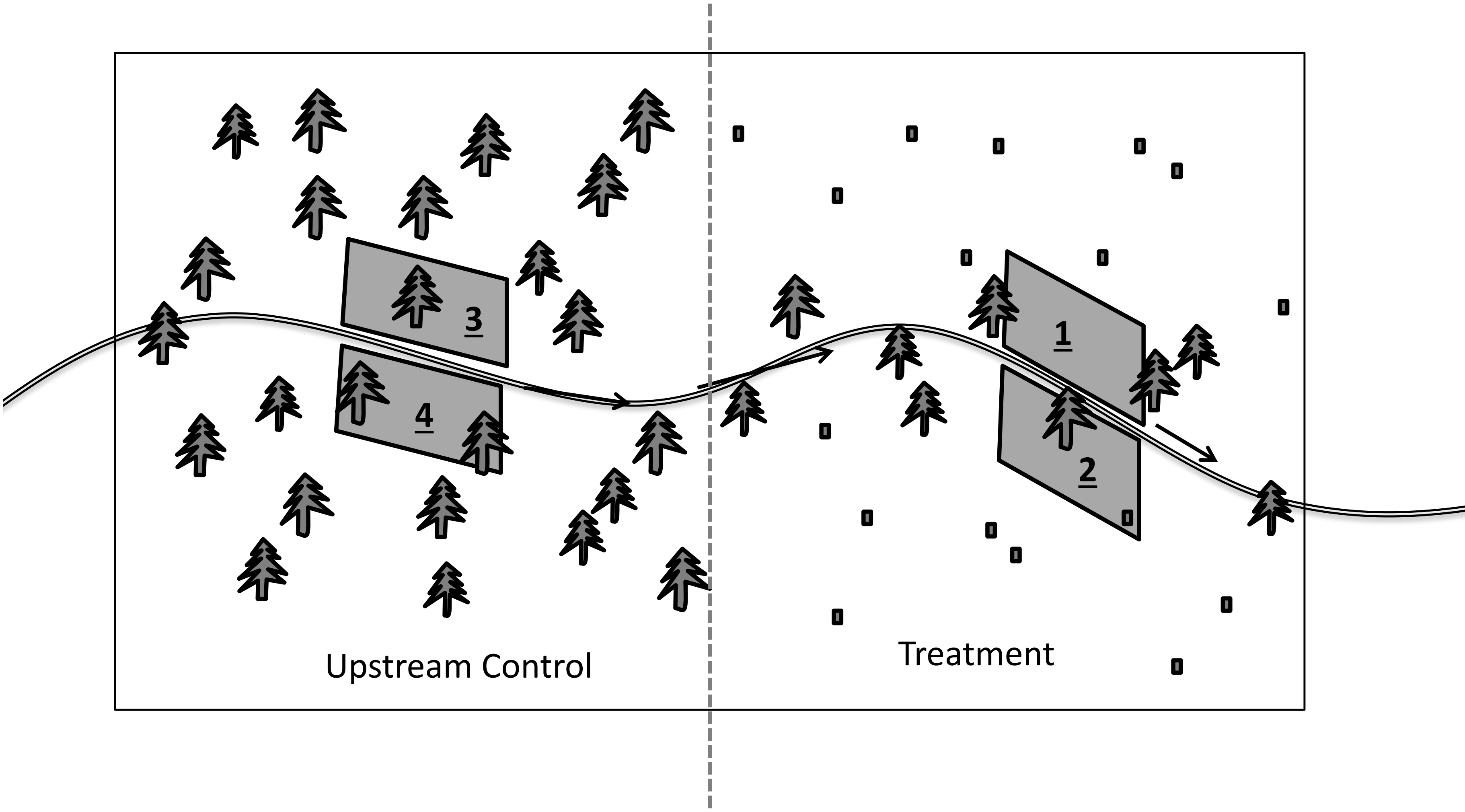
Outline

- Meeting goals
- Vegetation plots and what they tell us
- How we are using vegetation plot data
- Analysis
  - Background: what we're doing
  - How it works
  - Shade model alternatives & results
- Prediction: As harvested & State Forests
- Next Steps: FPA, alternatives

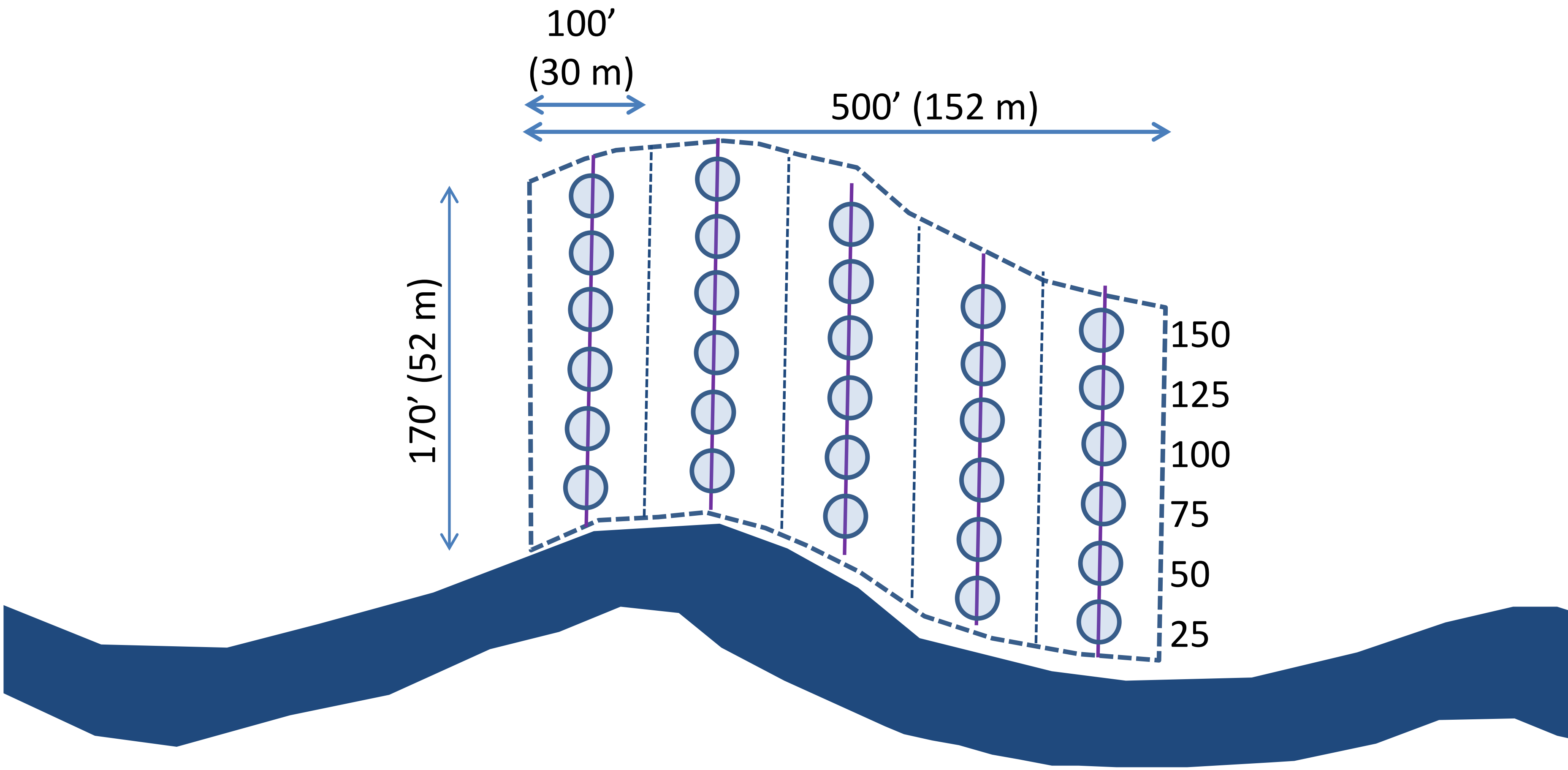
Goals

- Common understanding of model:
  - How it works
  - What goes into it
  - How it can be used
  - Role of the vegetation plot data
- Input on the model process
- Input on prescription development

PLOT LAYOUT



EPA-6822_001979

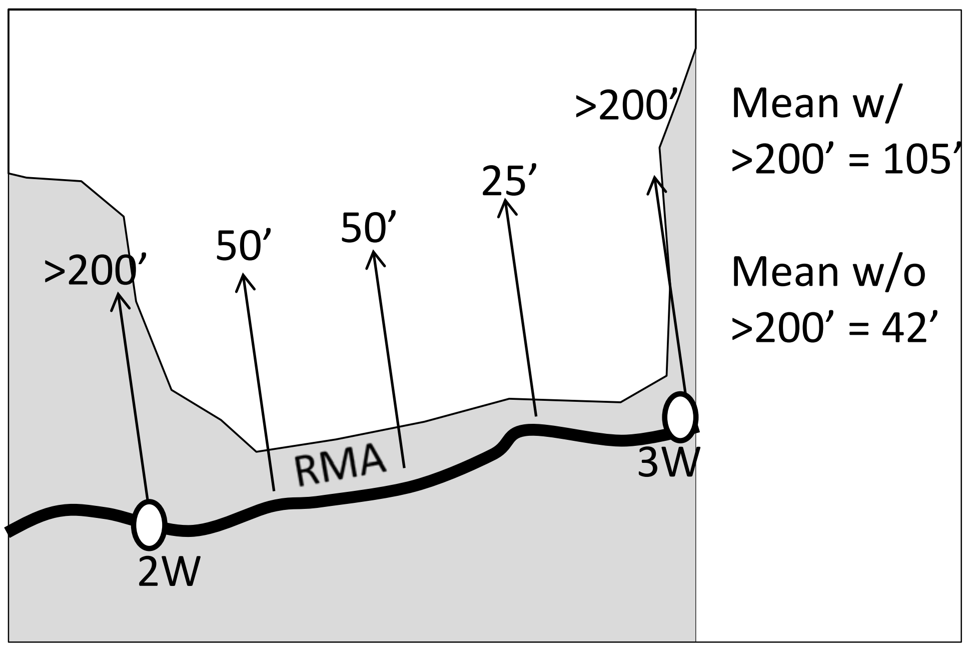

100’
(30 m)
500’ (152 m)
170’ (52 m)
150
125
100
75
50
25

Information from veg plots

- BA pre, post, change
- Species composition
- Tree height pre (not post)
- Snag/live
- Line that trees were harvested along
- Tree distance (horizontal, slope)
- Distance from stream to “harvest”

Distance

- FEM paper: used intern-measured buffer widths



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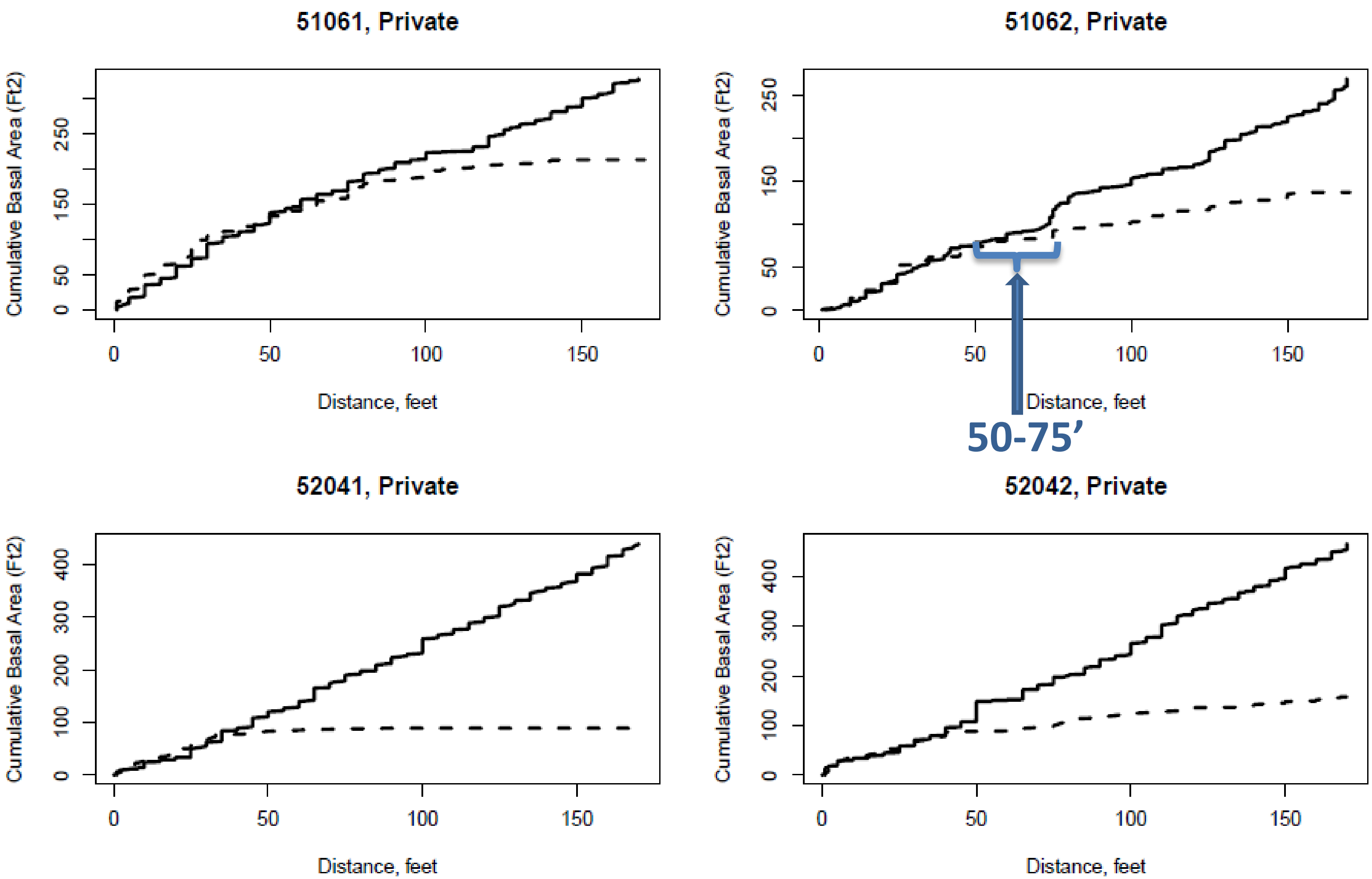
Distance – Vegetation Plots (visual)



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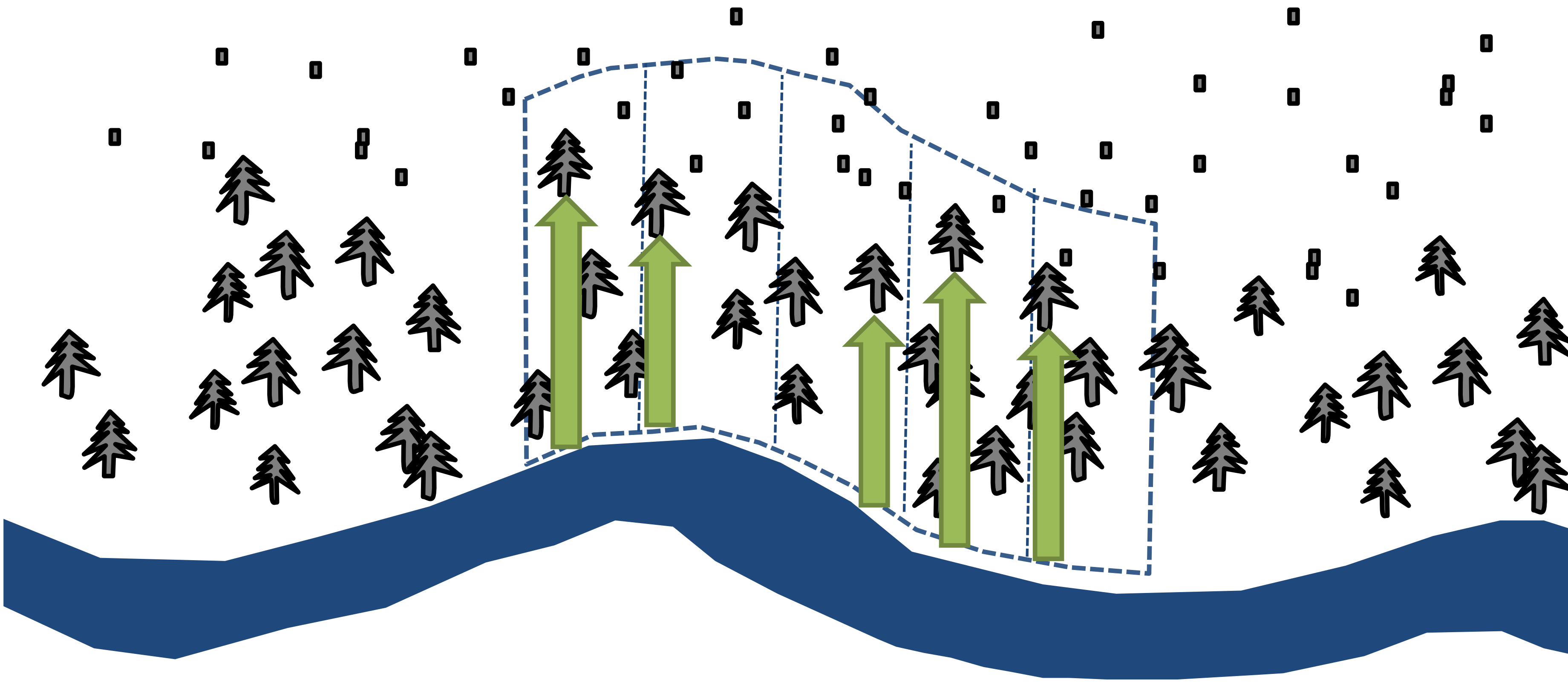
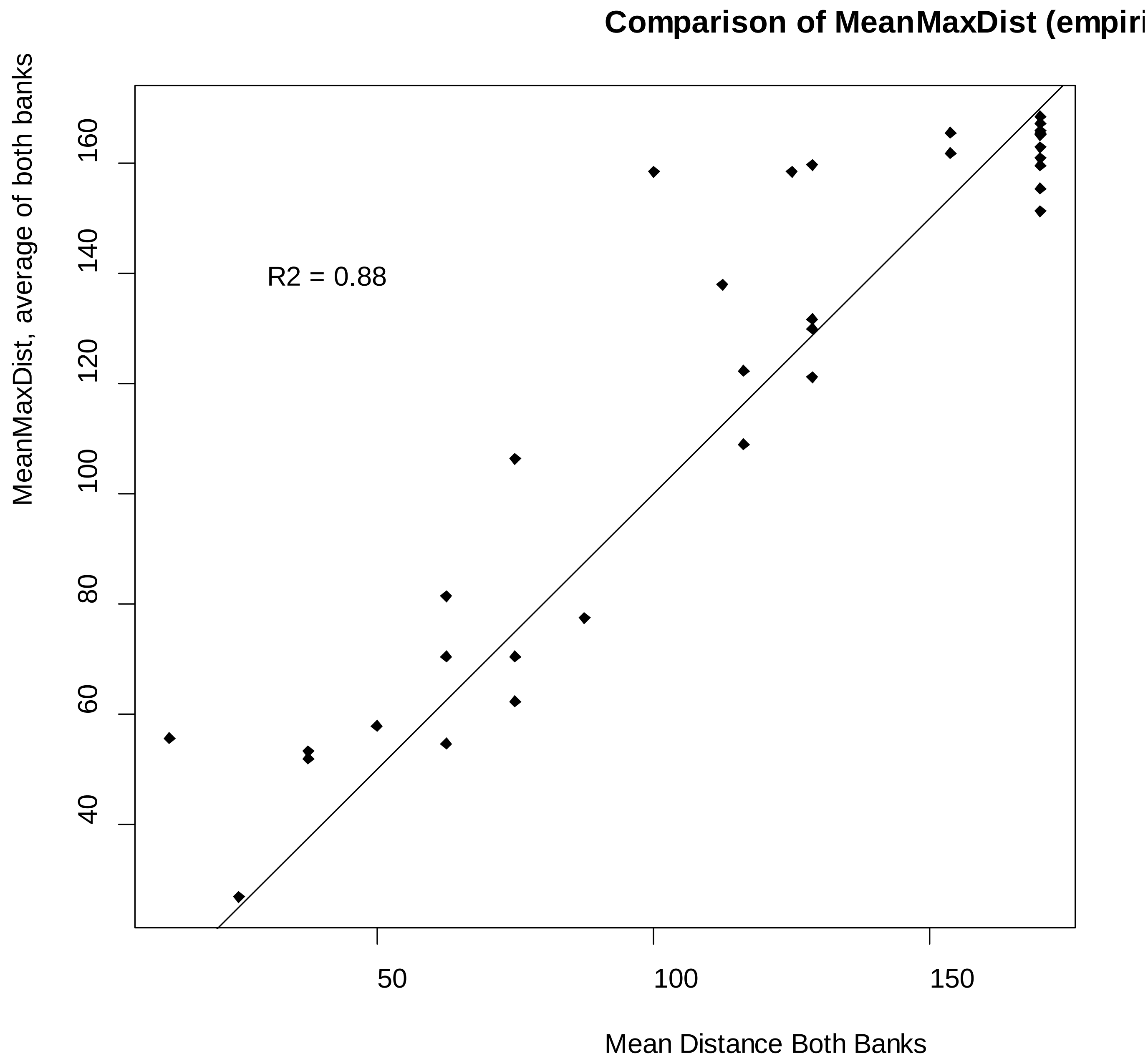
Distance: Vegetation Plot (Empirical)



DISTANCE
Which tree in each line is the farthest from the stream?

<u>Of the 5 maximum line distances…</u>

Minimum? MinMaxDist
Mean? MeanMaxDist
Max? MaxMaxDist



Comparison of MeanMaxDist (empiri
MeanMaxDist, average of both banks
40
60
80
100
120
140
160
R2 = 0.88
50
100
150
Mean Distance Both Banks

On to the Analysis…

Analysis path concept

Effects analysis

↓

Prediction tool

↓

Vegetation plot preparation

↓

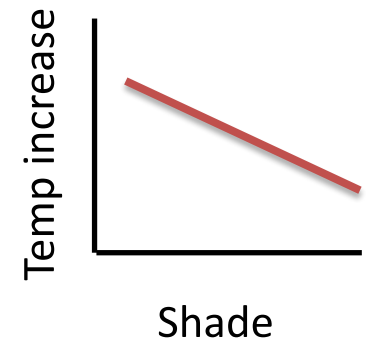
Rule alternative(s)

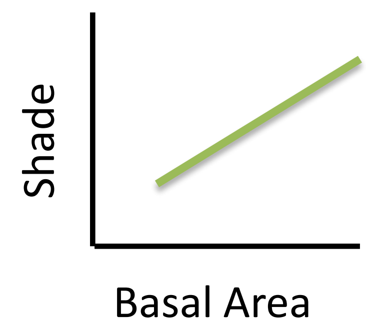
↓

Range of possibilities

↓

Suggested alterations





Analysis path concept

Effects analysis

↓

Prediction tool

↓

Vegetation plot preparation

↓

Rule alternative(s)

↓

Range of possibilities

↓

Suggested alterations

X Basal area

↓

Y Shade

↓

Z Temperature increase (+/-)

Analysis path concept

Effects analysis

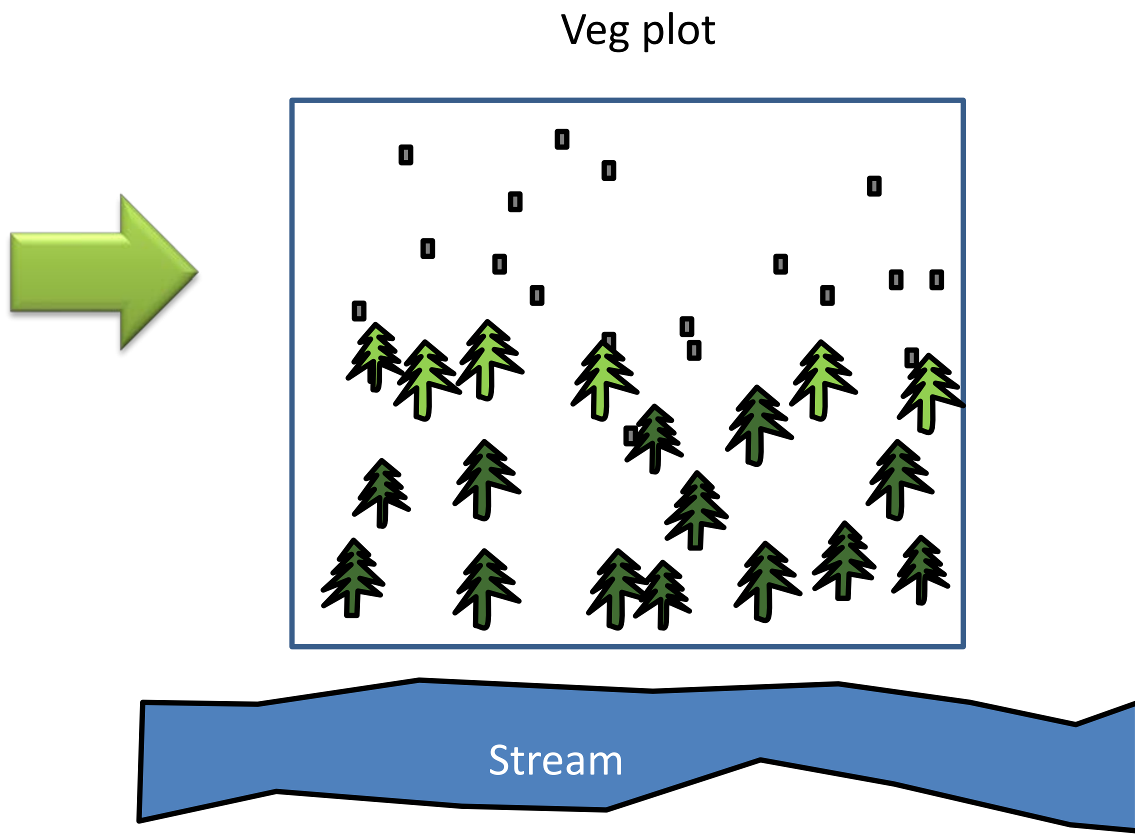
Prediction tool

Vegetation plot preparation

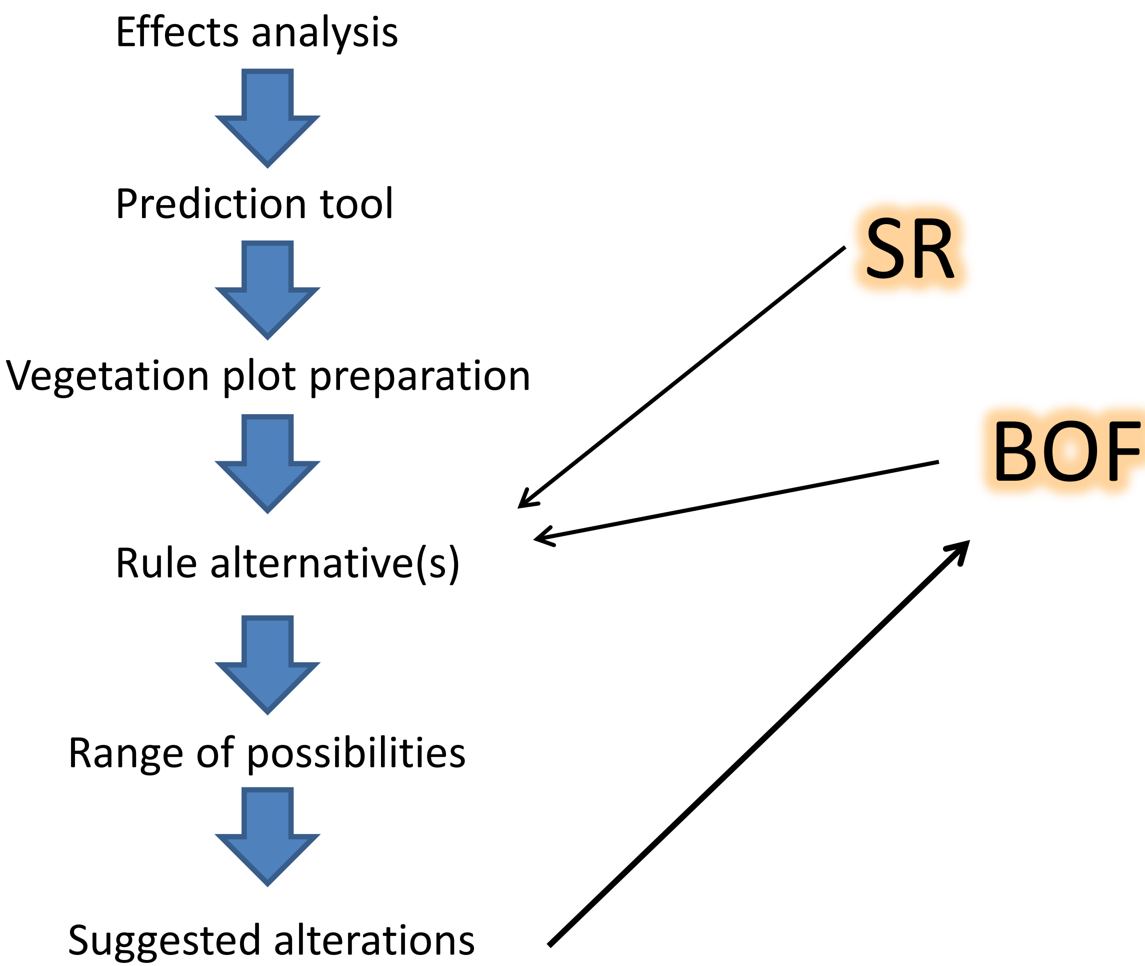
Rule alternative(s)

Range of possibilities

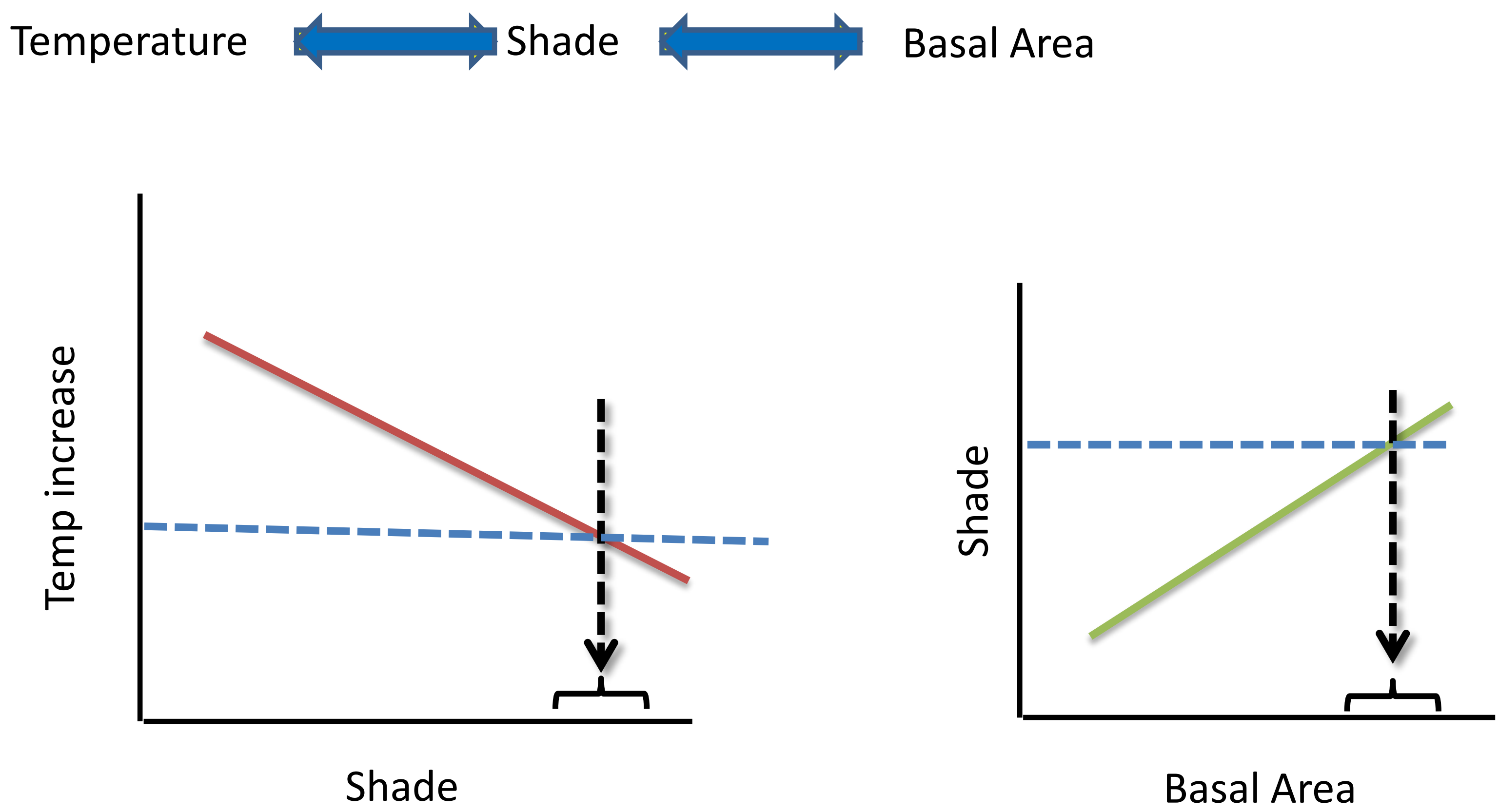
Suggested alterations



Analysis path concept

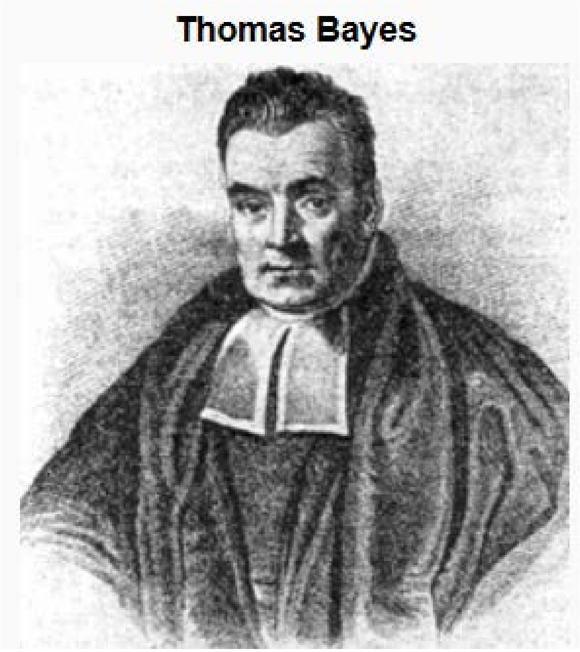


Prediction Tool



Linking analyses

How can we effectively "tie" analyses together?



Bayesian Analysis

- Bayesian & Frequentist
  - Frequentist: Data are random (random draws)
    - » Variables = fixed
  - Bayesian: Variables are random
    - » Data = fixed

- Key point: Models are the same.
  - Probabilities = different

Bayesian Analysis

- Why?? What does this give us?
  - Be able to say “80% chance that temperature increase will be less than 0.2 ˚C”
  - Single model, more information
    - Integrates many data sources easily, defensibly
  - Missing data estimated
  - Many assumptions, but true of MLE models too
    - Restrictions not as limiting

Making the jump

- Using same/similar models as before
  - Shade = weighted regression, Temp = mixed effects
- Coolness:
  - Two sites = missing pre-harvest temperature data, so analysis imputes values
  - With a Bayesian analysis, easy to estimate ***whatever***

- Get ready for equations

Stream Temperature Change

- Temperature: for year i, measuring temperature change in j site...

Mixed Effects

$$\Delta T_{3-2ij} = \alpha_0 + \alpha_j + (\beta_1 \Delta TControl_{2-1} + \beta_i \Delta TControl_{2-1j}) + \beta_2 TreatmentReachLength + \beta_3 Shade + \beta_4 GradientQuartile$$

EPA-6822_001996

Detour: shade model development

The ideal shade model

For RipStream, the ideal shade model…

- Explains shade results well
- Makes sense
- Includes all data out to 170’
- Includes a measure of harvest distance

Published model
Forest Ecology & Mgt 2011

Logit of shade = Basal area post-harvest + tree height

Model does well (explains ~ 70% variation)

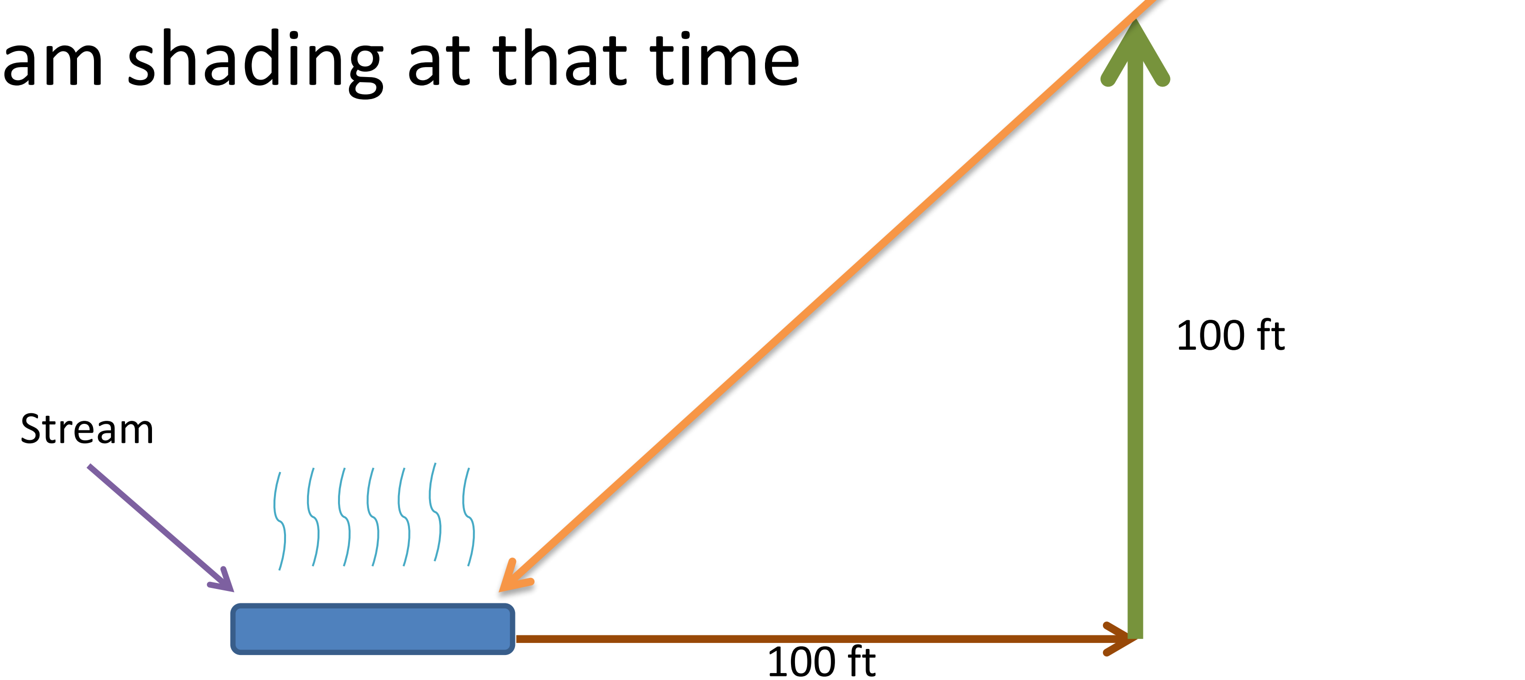
Examines forest out to 100’

Revised shade model: Shade 1

$$
\begin{aligned}
Shade_{Post} = {} & \alpha_{Shade} + \beta_{1Shade} Basal\ AreaPre + \beta_{2Shade} TreeHeight \\
& + \beta_{3Shade} Basal\ AreaPre * TreeHeight \\
& + \beta_{4Shade} BA\_Reduction + \beta_{5Shade} PctHardwoodPre
\end{aligned}
$$

Why 100'?

- Trees ~ 100' tall
- Most intense radiation between 10:00 & 2:00
- In summer, trees > 100' have little effect on stream shading at that time



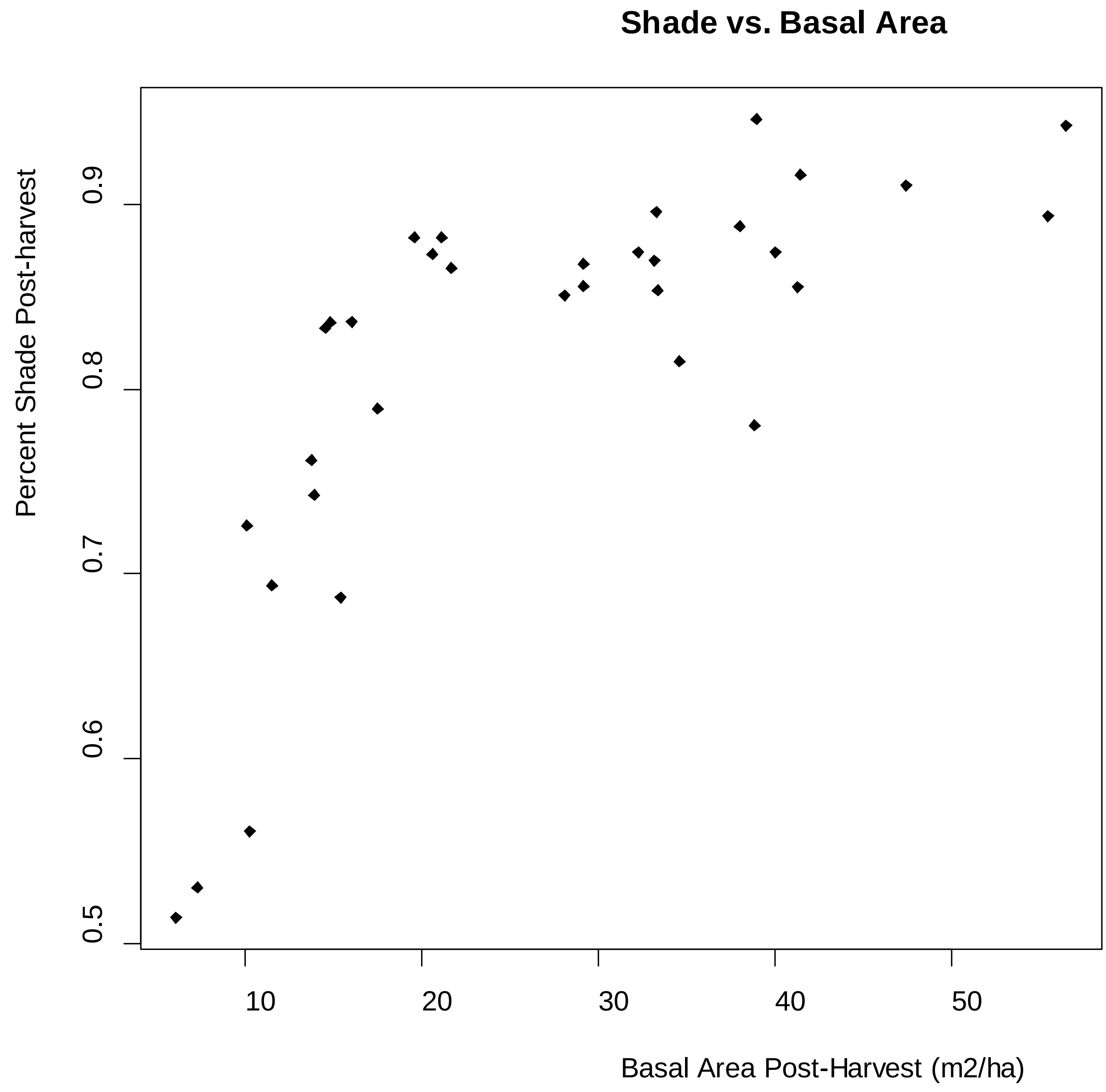
Out to 170'… how to include distance?

- We can include all trees out to 170'

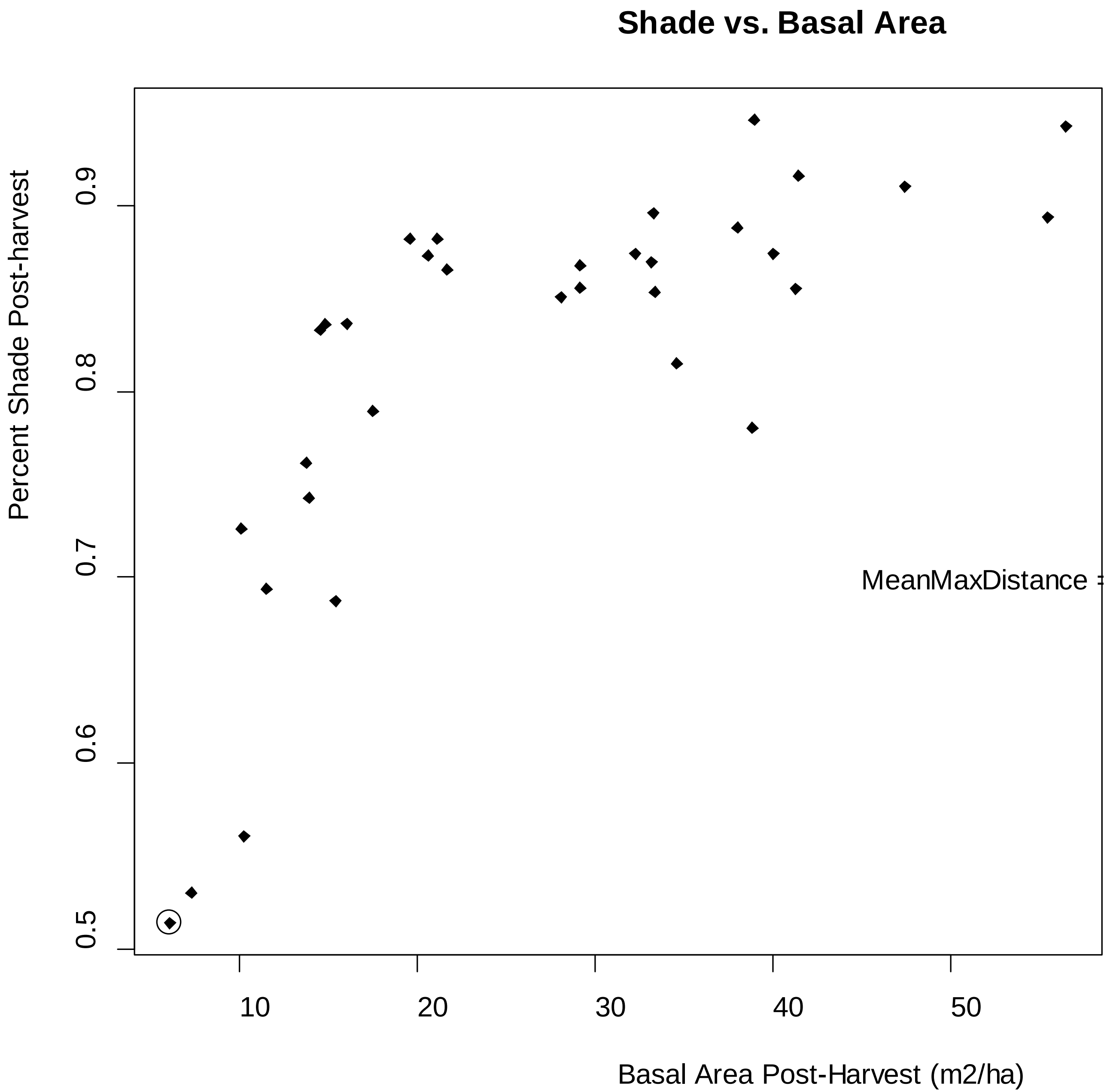
- How do we include a measure of distance in the analysis? (What was the relationship between shade and distance?)

- How do we relate distance to basal area?

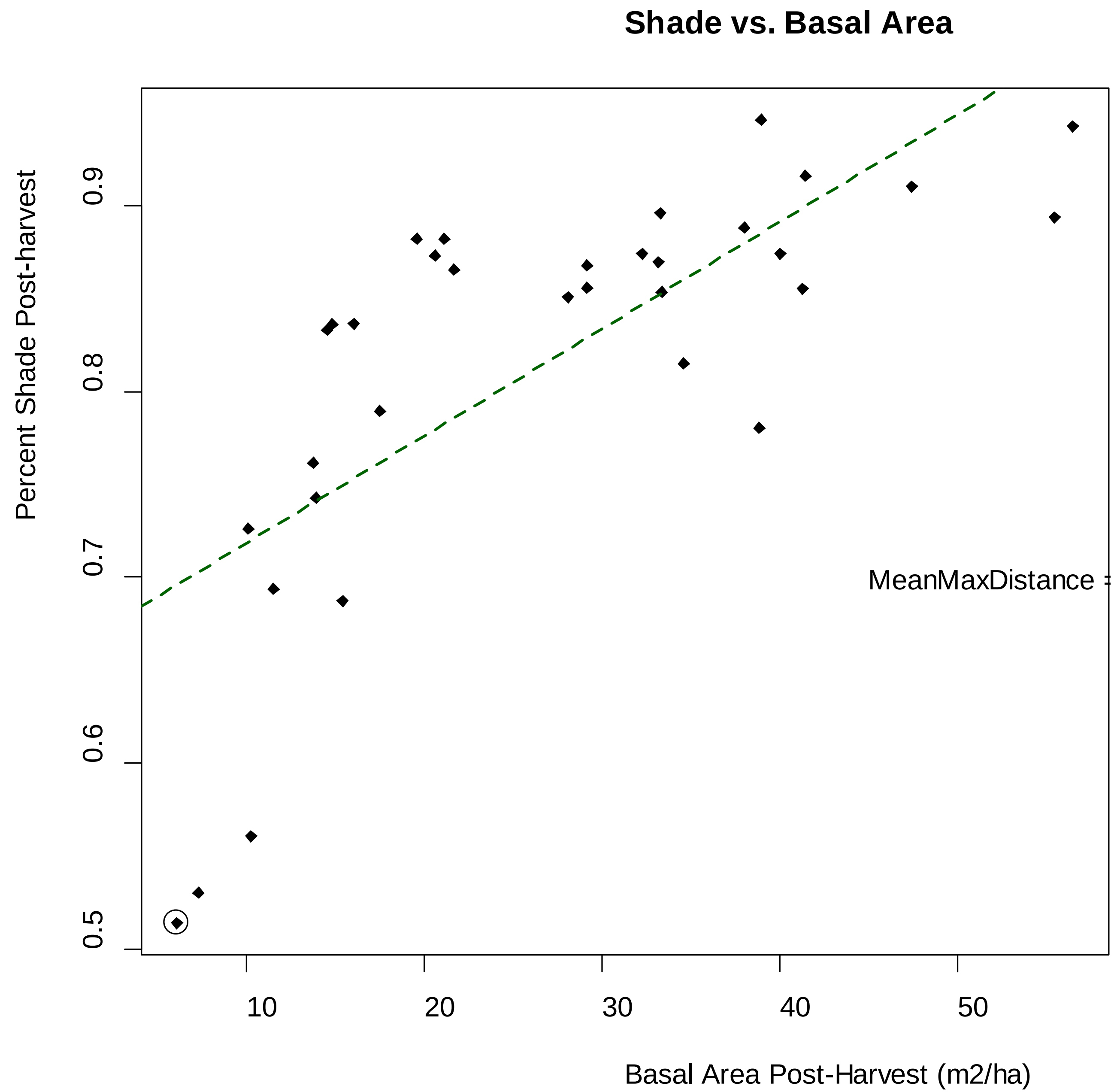
Using MeanMaxDist

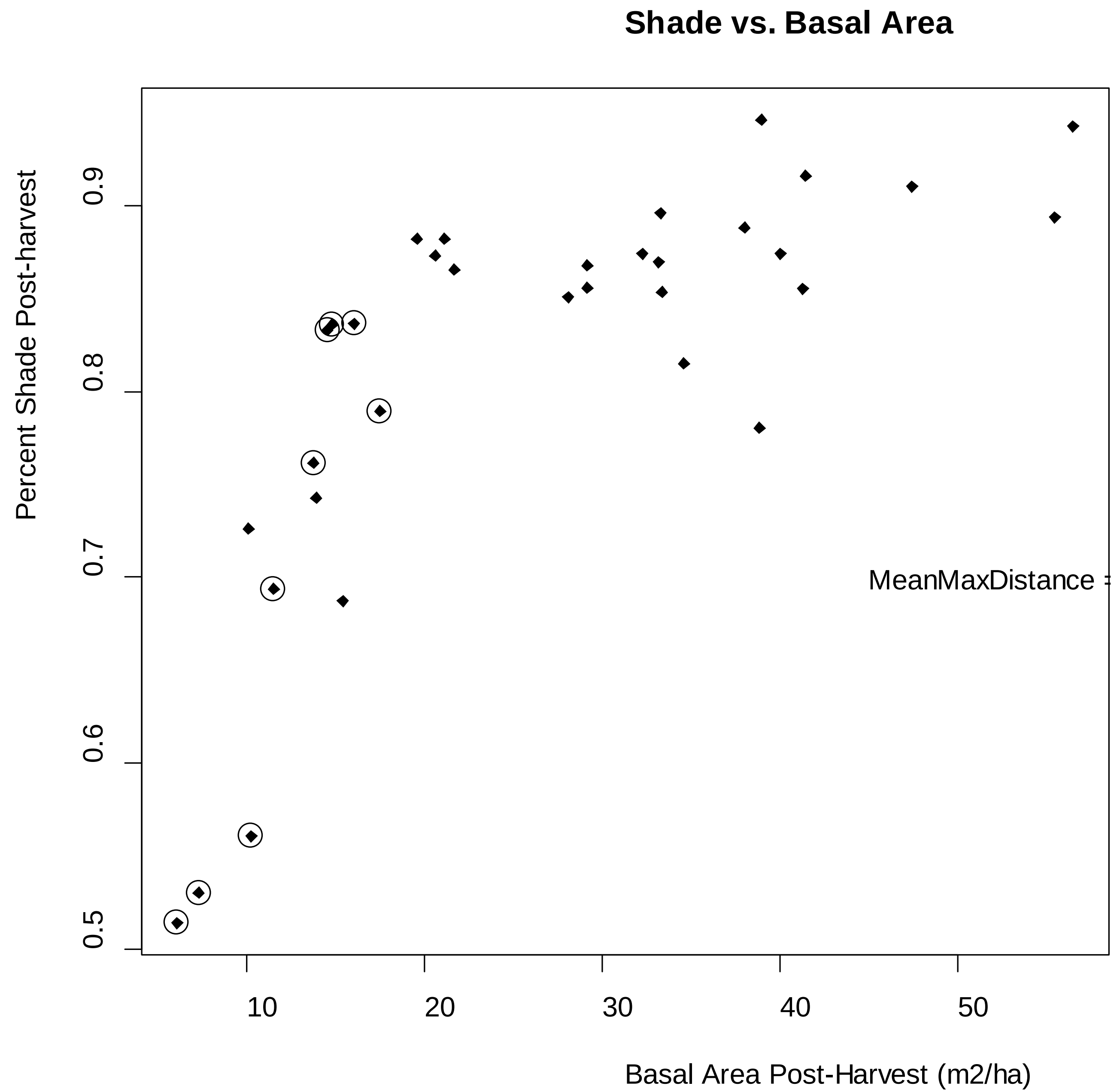


EPA-6822_002003

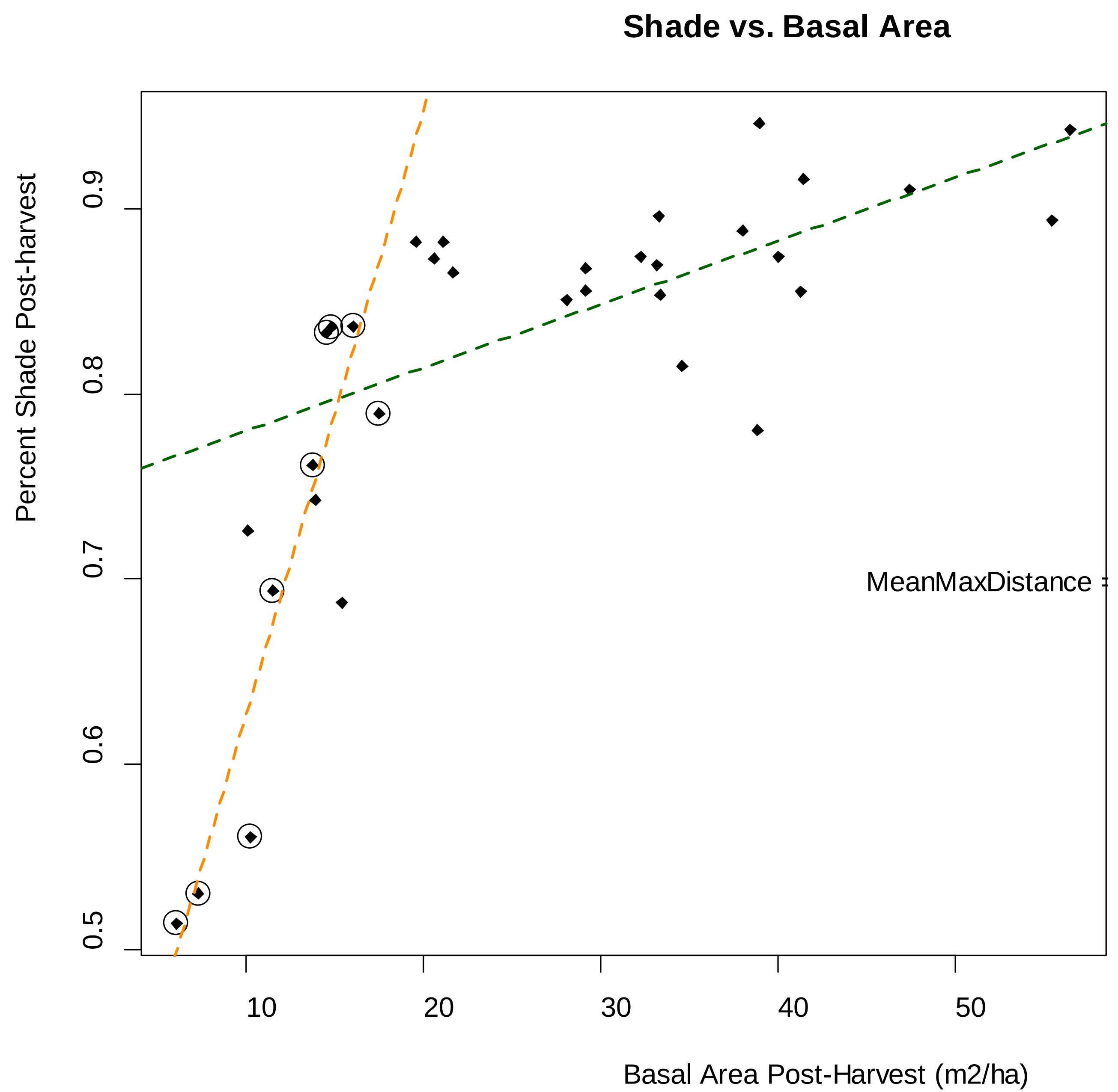


Shade vs. Basal Area
Percent Shade Post-harvest
0.5
0.6
0.7
0.8
0.9
10
20
30
40
50
MeanMaxDistance =
Basal Area Post-Harvest (m2/ha)

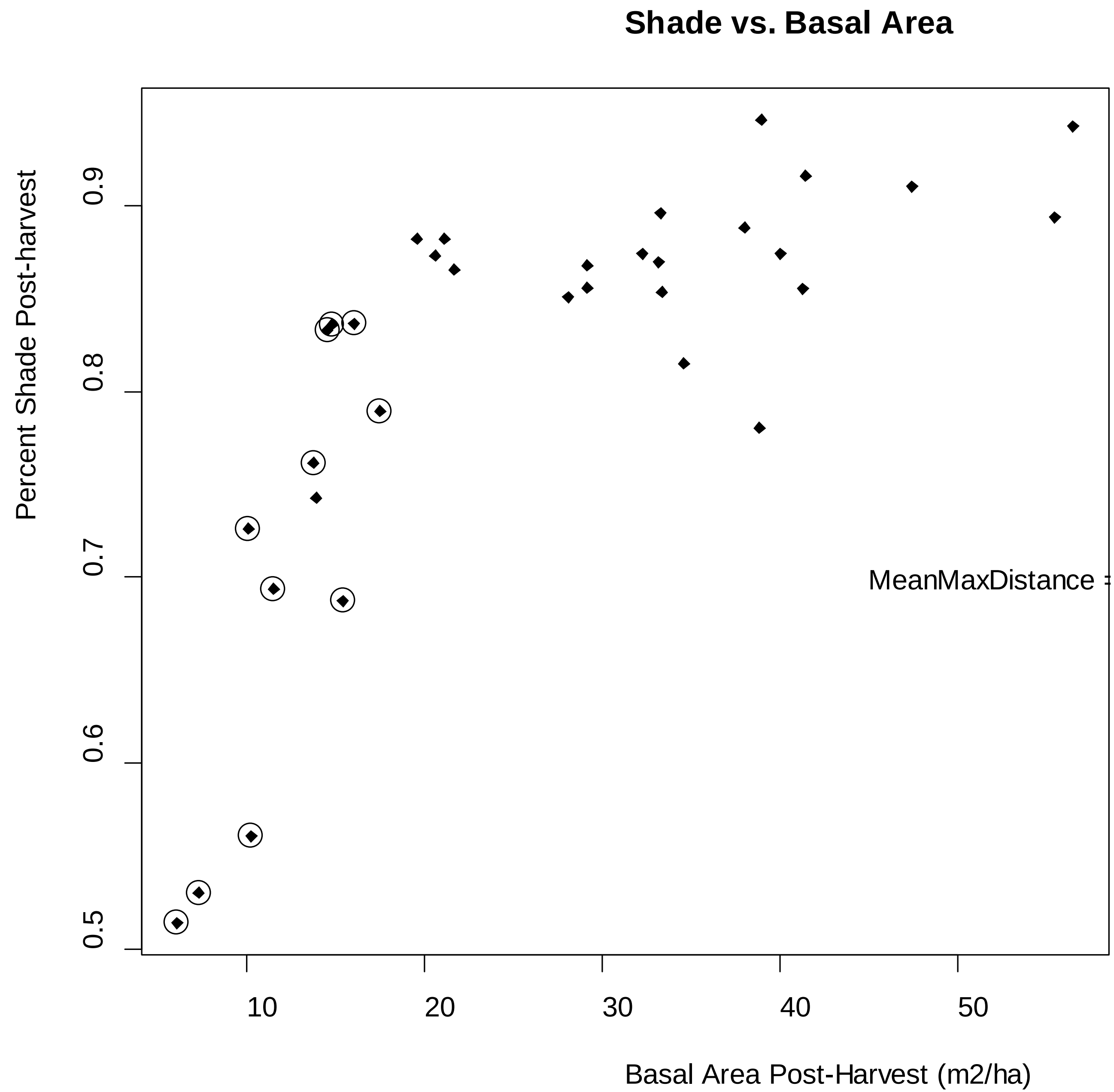

Shade vs. Basal Area
Percent Shade Post-harvest
0.5
0.6
0.7
0.8
0.9
10
20
30
40
50
Basal Area Post-Harvest (m2/ha)
MeanMaxDistance =



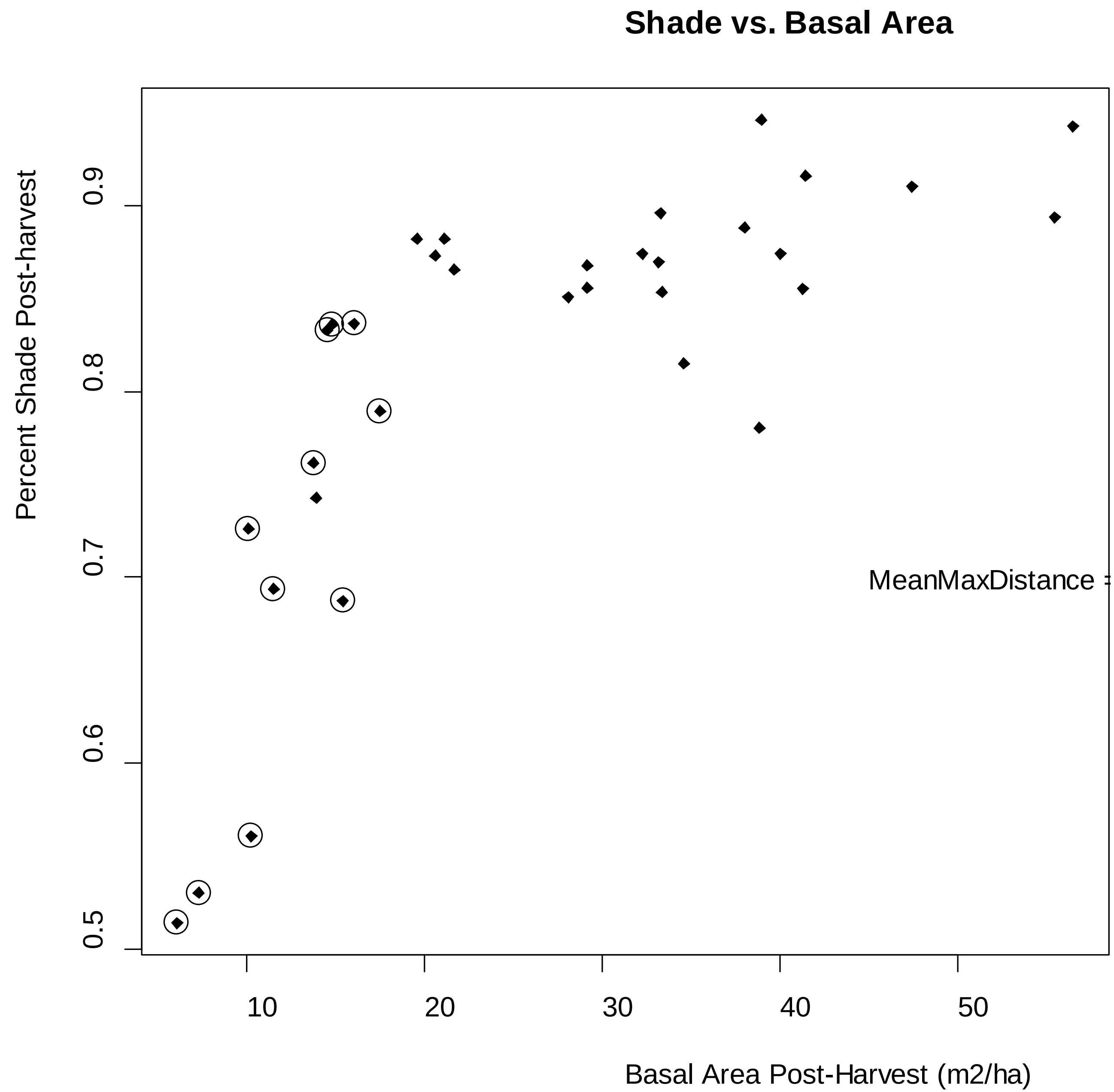
EPA-6822_002006



Shade vs. Basal Area
Percent Shade Post-harvest
0.5
0.6
0.7
0.8
0.9
10
20
30
40
50
MeanMaxDistance =
Basal Area Post-Harvest (m2/ha)

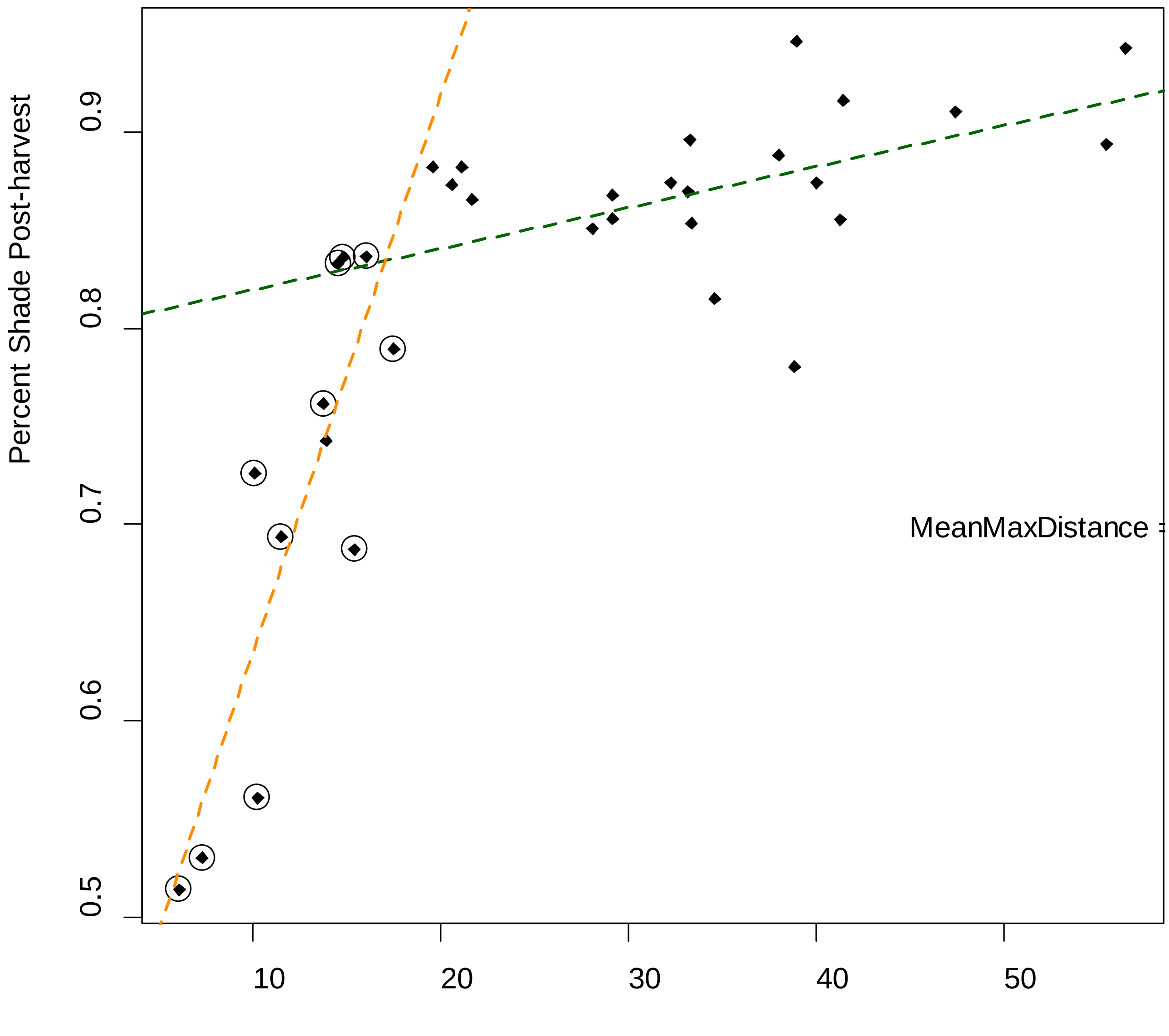


EPA-6822_002008

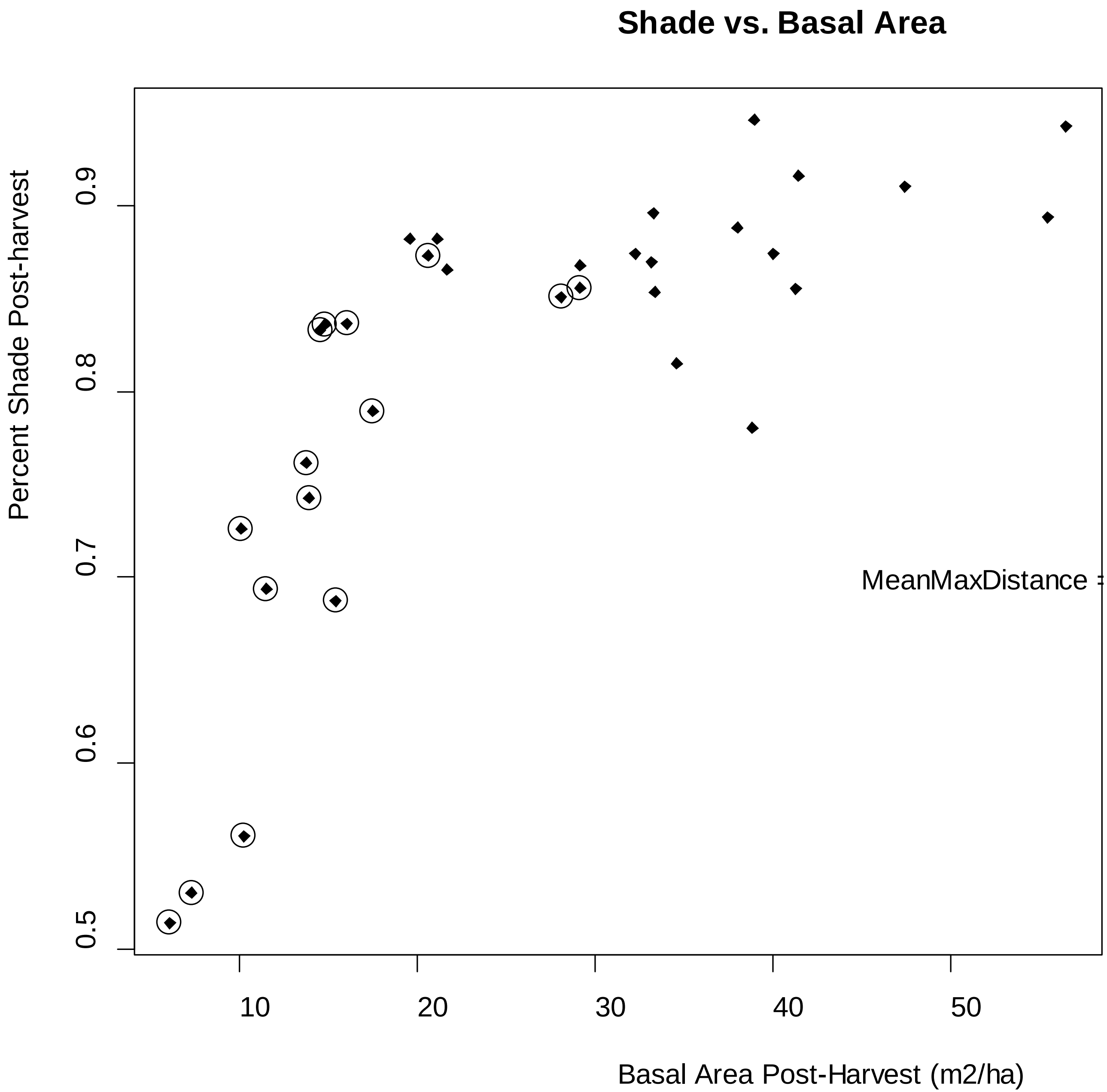


EPA-6822_002009

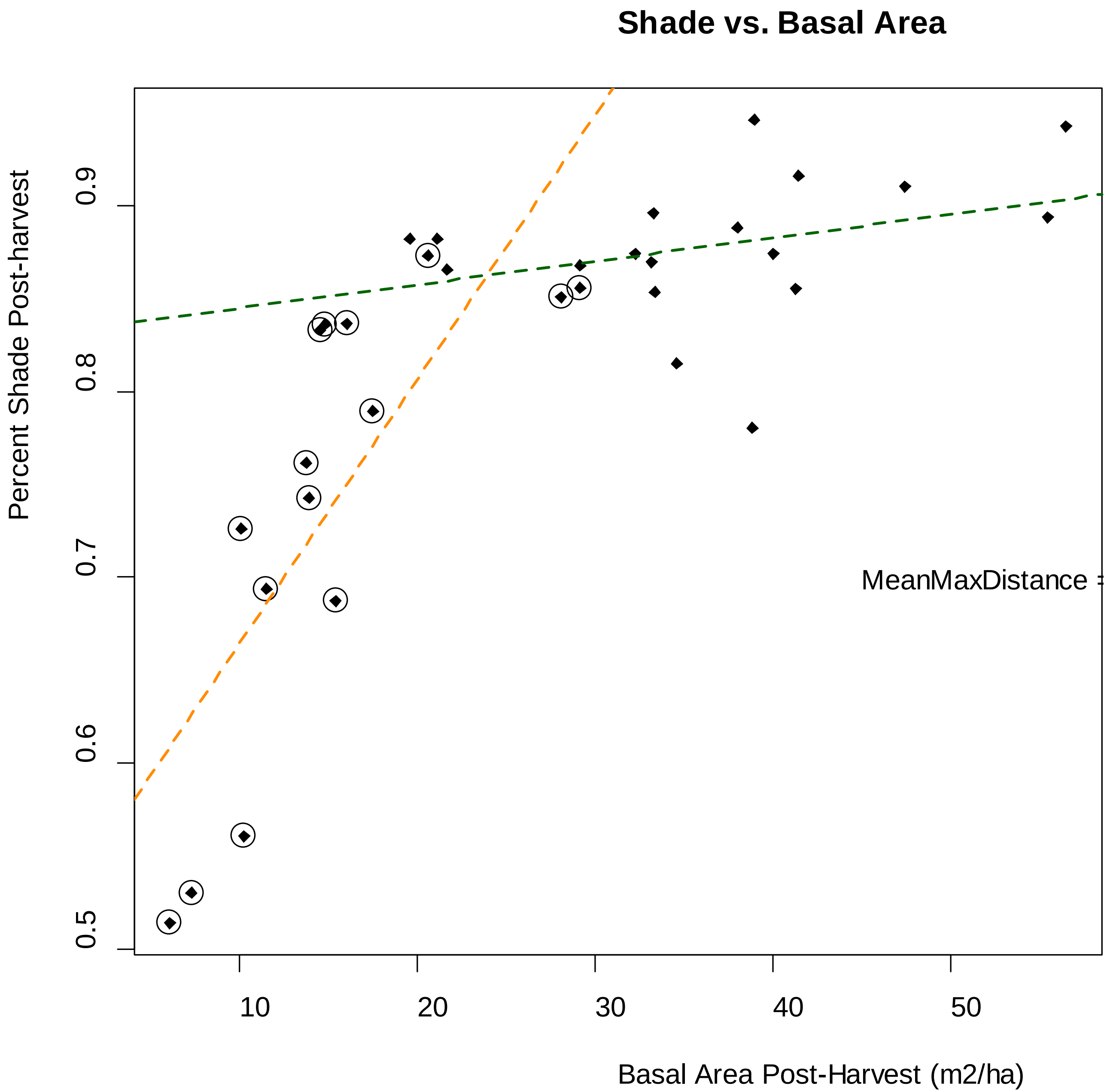
Shade vs. Basal Area



EPA-6822_002010



EPA-6822_002011



EPA-6822_002012

Shade v.2.0

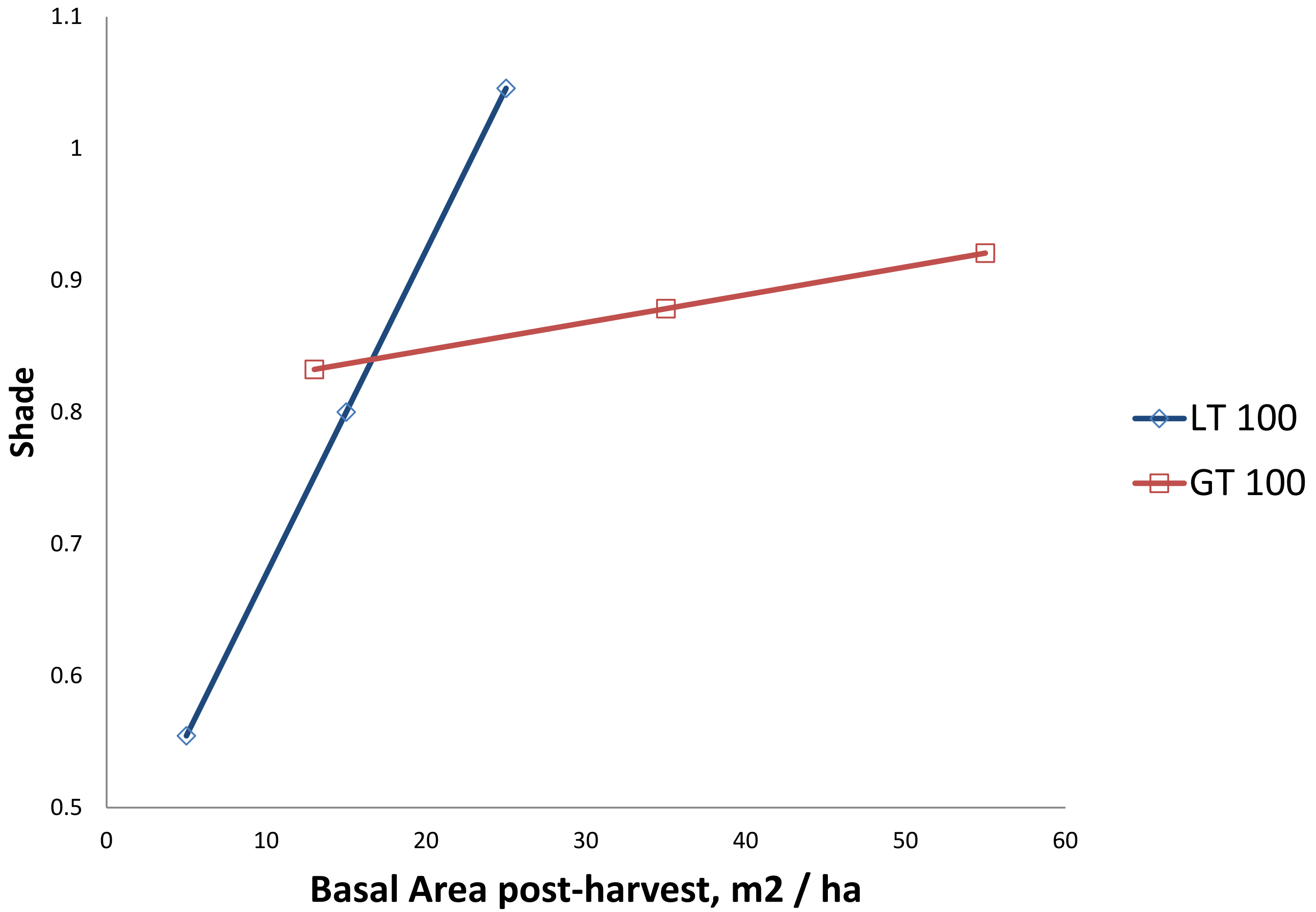
- Pre-harvest: Shade = raw shade data
  (not modeled)

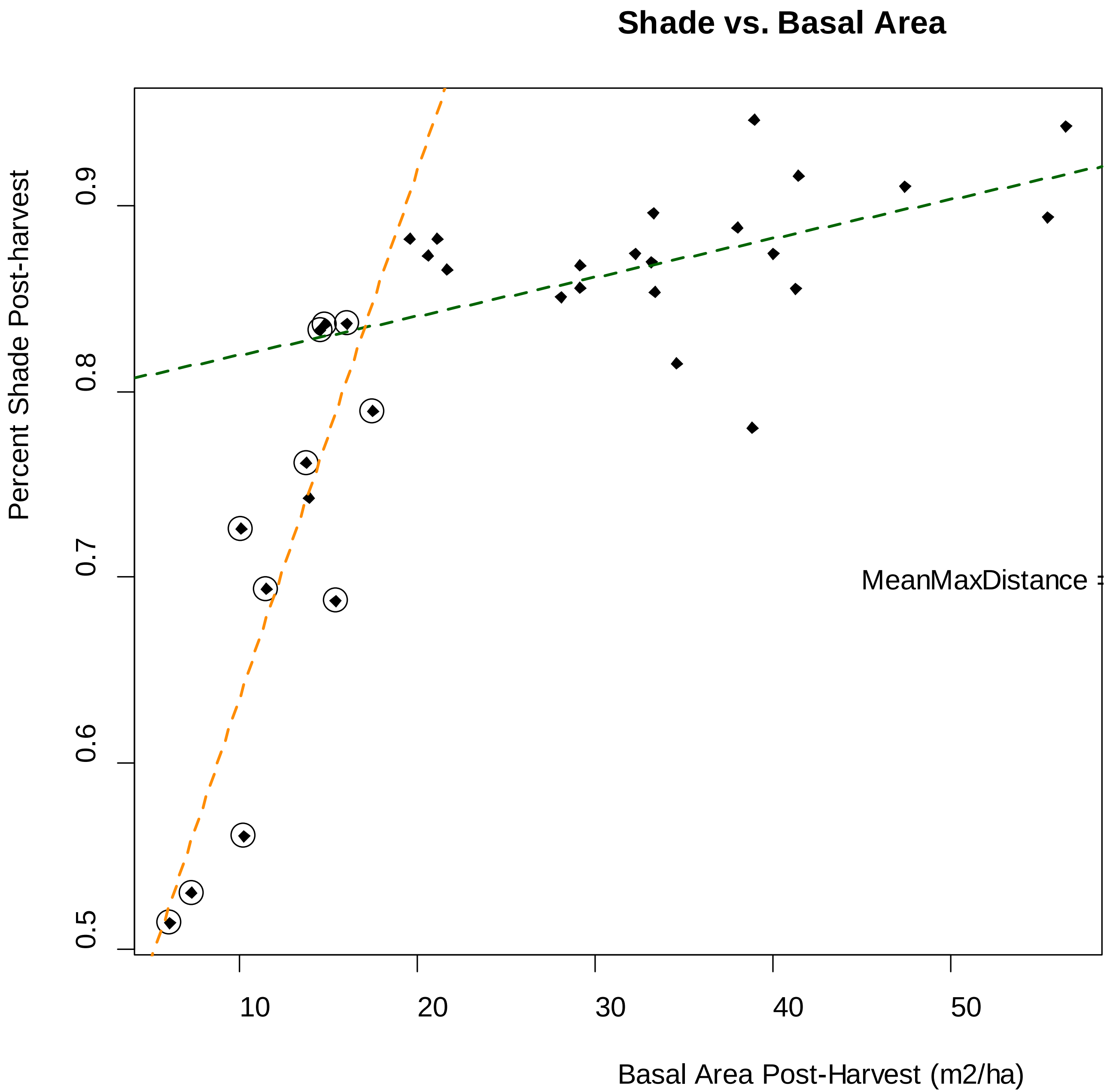
- Post-harvest:

$$
\begin{aligned}
Shade_{Post} &= \alpha_{Shade} + \beta_{1Shade}\boxed{LT100} + \beta_{2Shade}\boxed{BasalAreaPost170} \\
&+ \beta_{3Shade}\boxed{LT100} * \boxed{Basal\ AreaPost170} \\
&+ \beta_{4Shade} TreeHeightPre170
\end{aligned}
$$

EPA-6822_002013

Shade retention by incursion distance, </>100', mean veg plot extent

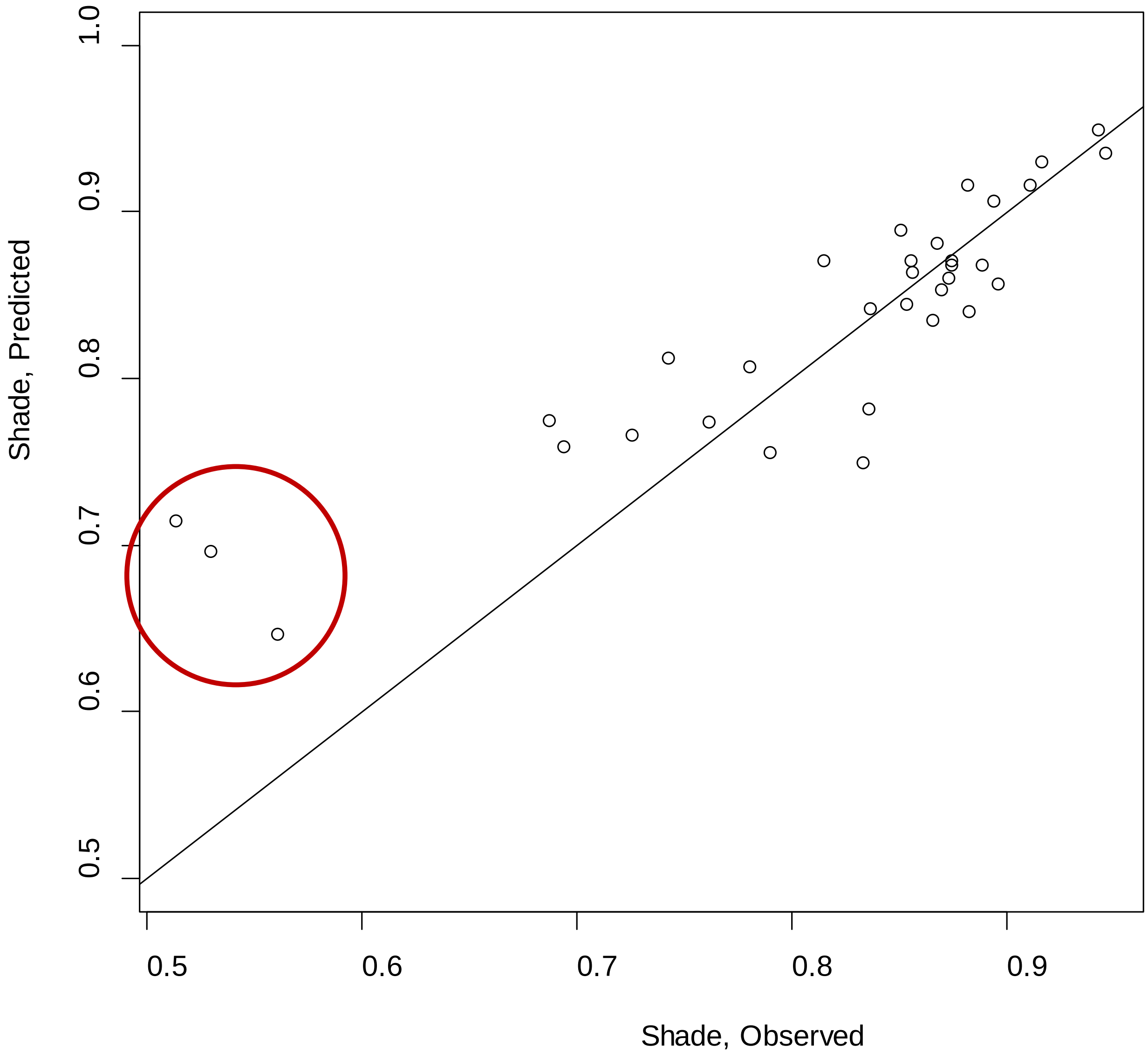



Shade vs. Basal Area
Percent Shade Post-harvest
0.5
0.6
0.7
0.8
0.9
10
20
30
40
50
MeanMaxDistance =
Basal Area Post-Harvest (m2/ha)

Shade decisions

- Reason to limit BA examined to <100’
- Didn’t like Shade 1 (fit, too many variables, hard to explain)
- Logit of shade?

Shade 1: Observed data vs. Predicted data



Shade 4(?)

- Within 100' of stream
- Logit shade depends on

  % difference in basal area

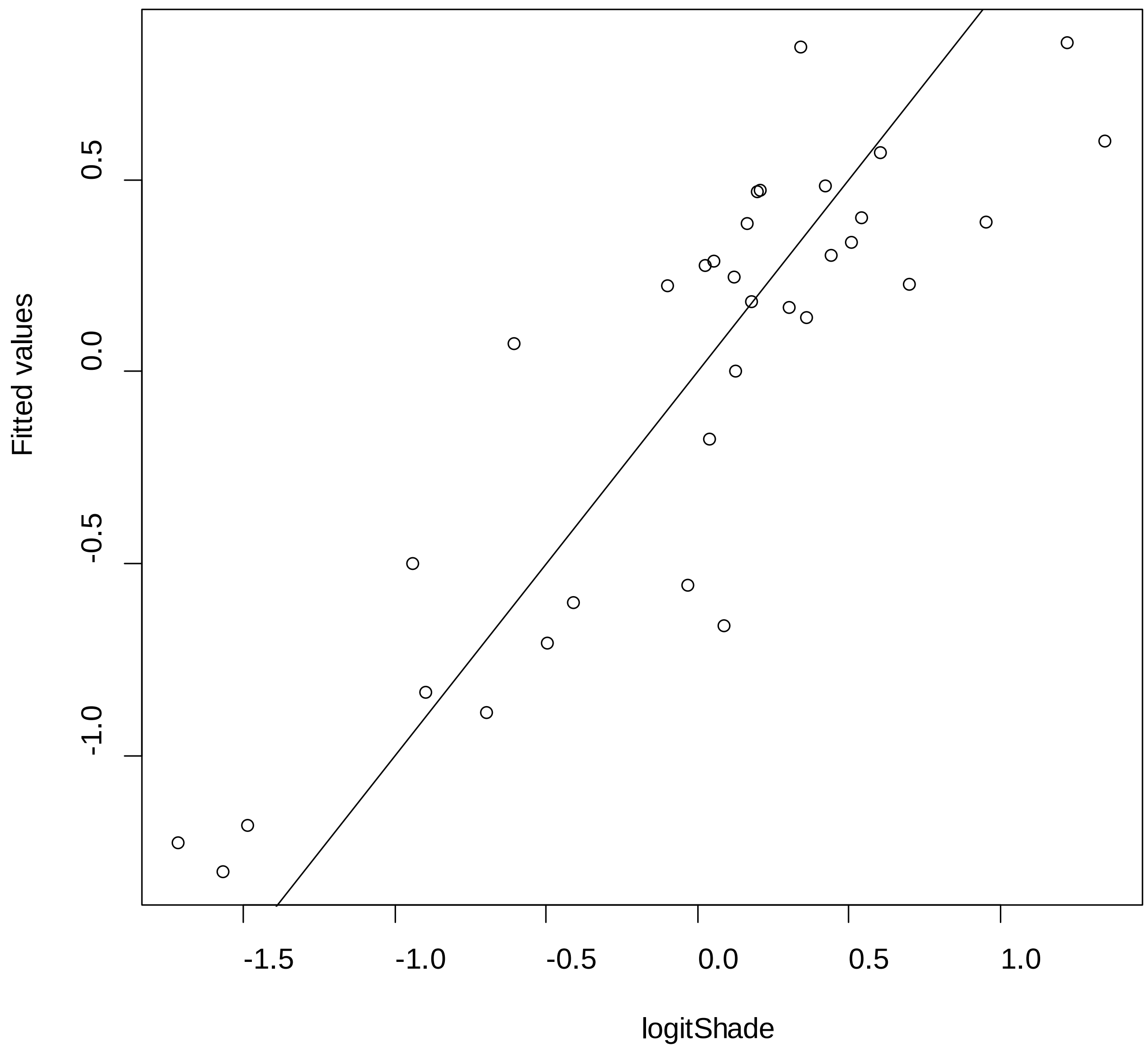
  Percent hardwood (preharvest)

  Tree height (like original model)

[4] $$Logit\ Shade_{Post} = \alpha_{Shade} + \beta_{1Shade} PctDifferenceBA_{100} + \beta_{2Shade} PctHWD_{Pre100} + \beta_{3Shade} TreeHt_{100})$$

$R^2 = 0.78$

Pred vs. observed values for lm2.6, l



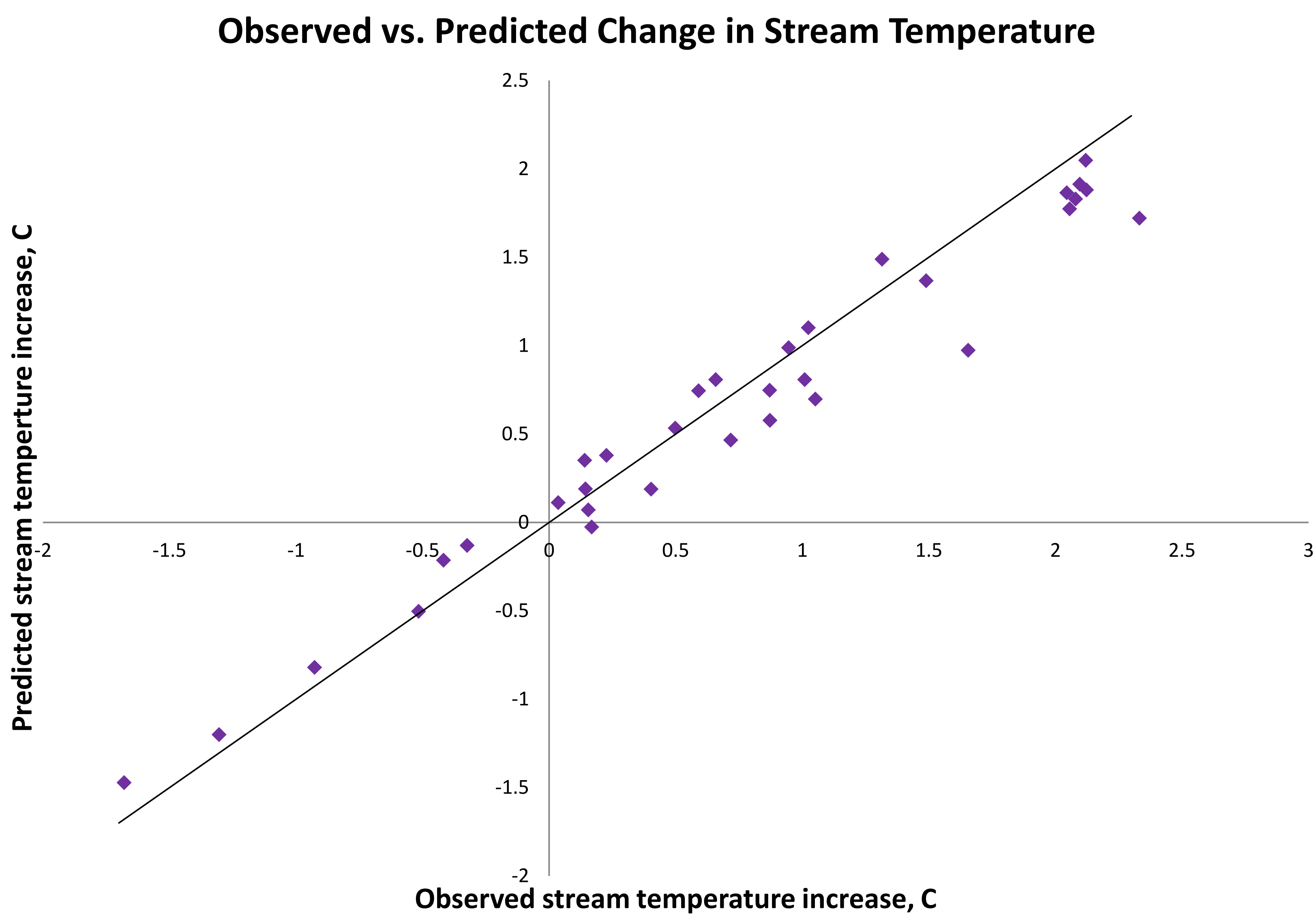
Back to the Analysis…

All estimated at once, Shade 4

$$
\begin{aligned}
&Logit\ Shade_{Post} \\
&\qquad = \alpha_{Shade} + \beta_{1Shade} PctDifferenceBA_{\ 100} + \beta_{2Shade} PctHWD_{Pre10} \\
&\qquad + \ \beta_{3Shade} TreeHt_{100})
\end{aligned}
$$

$$
\begin{aligned}
\Delta T_{3-2ij} = \ & \alpha_0 + \alpha_j \ + (\beta_1 \Delta TControl_{2-1} + \beta_i \Delta TControl_{2-1j}) \\
& + \beta_2 TreatmentReachLength + \ \beta_3 Shade_{Post} \\
& + \ \beta_4 GradientQuartile
\end{aligned}
$$

EPA-6822_002021



Observed vs. Predicted Change in Stream Temperature
Predicted stream temperture increase, C
Observed stream temperature increase, C
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
3

Prediction

$$\begin{aligned}\Delta\hat{T}_{3-2ij} = \ & \alpha_0 + \alpha_j + (\beta_1 \Delta TControl_{2-1} \\ & + \beta_i \Delta TControl_{2-1j}) \\ & + \beta_2 TreatmentReachLength \\ & + \beta_3 (inverse\ logit\ of\!: \alpha_{Shade} \\ & + \beta_{1Shade} PctDifferenceBA \\ & + \beta_{2Shade} PctHwd_{100} \\ & + \beta_{3Shade} TreeHeightPre_{100}) \\ & + \beta_4 GradientQuartile\end{aligned}$$

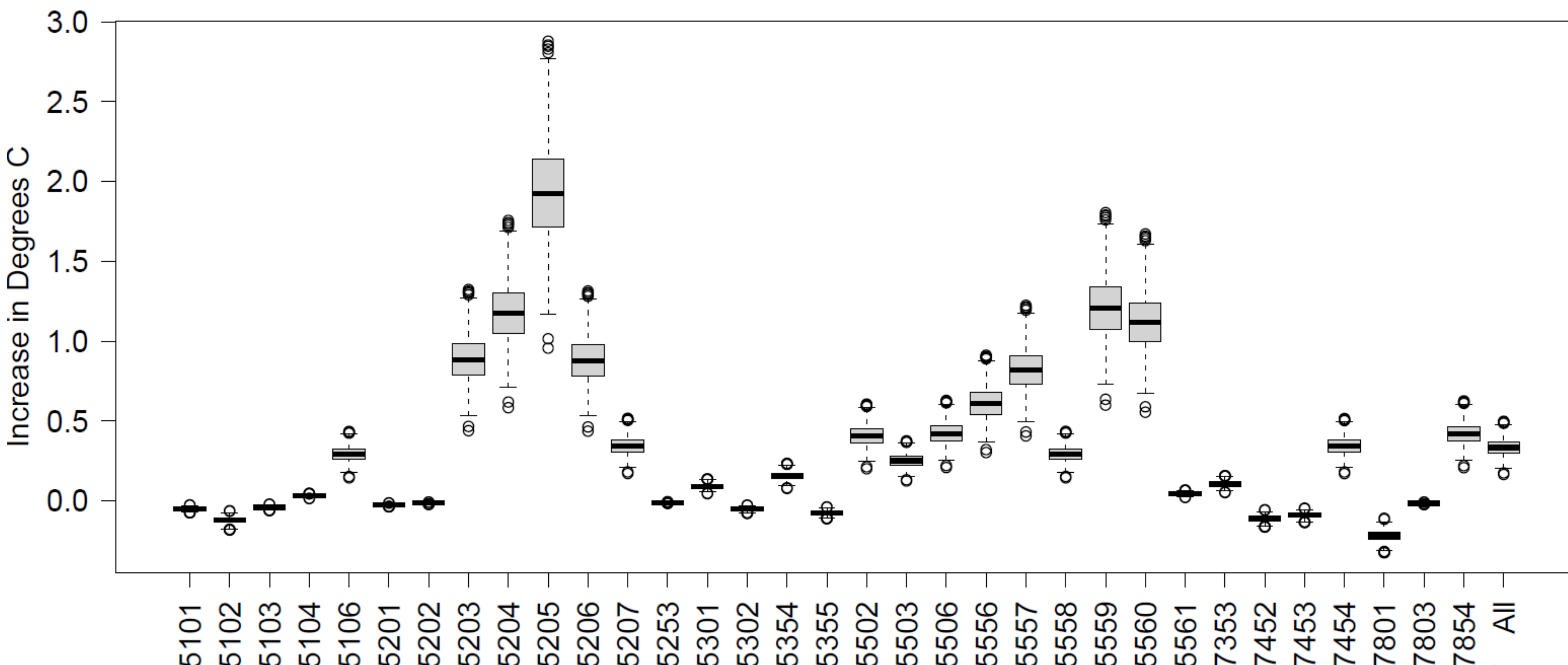
For first year post-harvest, **BA_Reduction** =

1) Simulated change 2) Zero change

→ Subtract these values. Get estimates.

As Harvested – Predicted (Shade 2)

State Mean = 0.001 Private = 0.57



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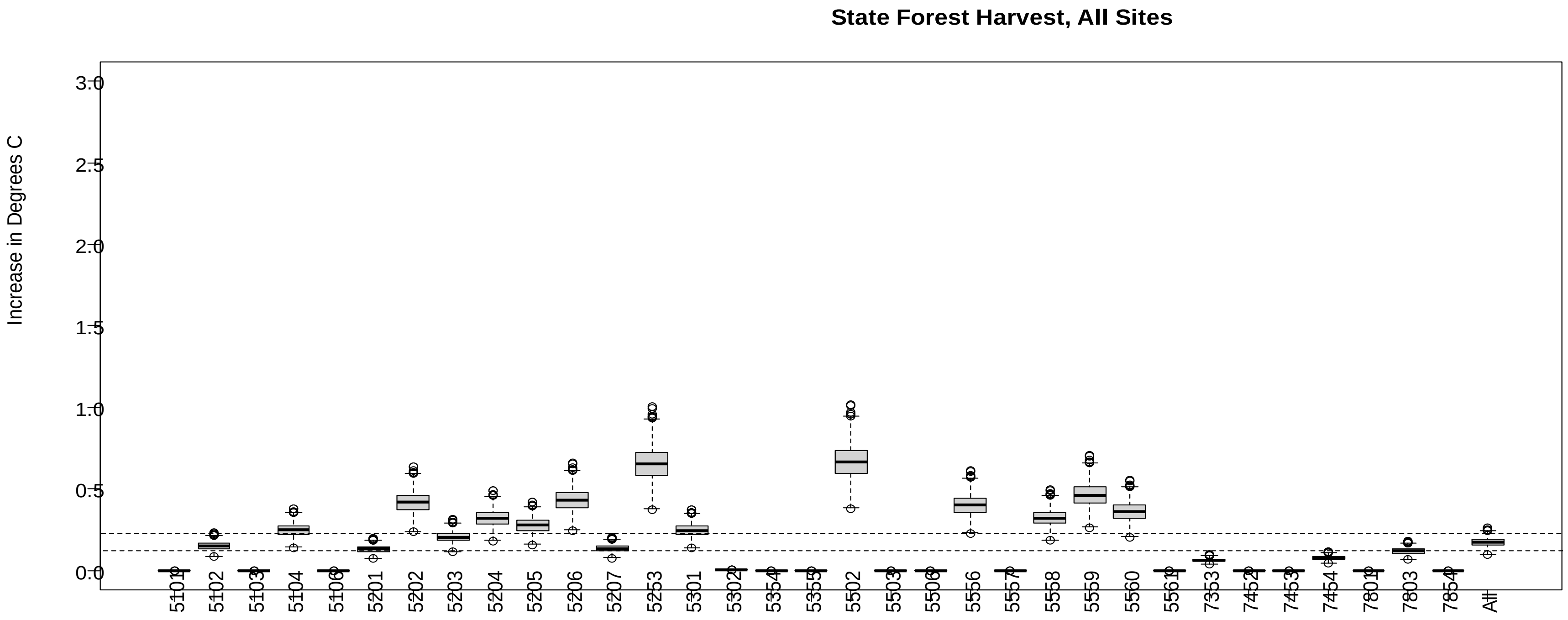
Harvest simulation

- Simulate harvests by specifying:
  - hardwood and conifer BA retention
  - Distance of no-cut buffers
  - Retention by diameter class
  - Number of retention trees
  - SDI
  - Height (harder)
- Report resulting basal area, basal area reduction, harvest distance (LT100)

- Can report other metrics

State Forests – Simulated (Shade 2, < 100')

Quantiles: 50% = **0.17** 75%= **0.19** 95% = **0.21**



Next Steps

- Statistician input (Friday)
- Finalize shade model selection
- Predictions for SF & Private
  - Incorporating slope distance correction for Private
- Sensitivity analysis
- Explore suite of possible prescriptions
- Write up methods